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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/508,996	09/27/2004	Alessandro Tredicucci	Q83897	1328

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EXAMINER	
VAN ROY, TOD THOMAS	
ART UNIT	**PAPER NUMBER**
2828	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/28/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/508,996	TREDICUCCI ET AL.	
	Examiner	Art Unit	
	Tod T. Van Roy	2828	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on *19 January 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Specification

The disclosure is accepted.

Response to Amendment

The examiner acknowledges the amending of claims 1-8 and 12-13.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 3-4 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The examiner does not believe that the 112 rejections have been properly addressed by the applicant as found in the Remarks (01/19/2007).

The applicant has stated that the dielectric constant ($\varepsilon 2$) is generic and could represent a different value for each of the surrounding regions. The examiner is of the belief that this language is indefinite as we are using one variable name to describe two possibly differing values in two regions. The use of ($\varepsilon 2$) and ($\varepsilon 3$) is suggested.

The applicant has not addressed the 'module' language. The specification (pgs.5-6) describes the use of a 'modulus', a mathematical term equivalent to an absolute value, but makes no mention of a 'module'. The word 'module' is not known to have a mathematical meaning that would make sense for its use here.

The applicant further did not address whether the 'module' of the dielectric constant (ε2) is compared solely to the (ε1) value, or to the 'module' of (ε1). The specification is believed to actually describe the opposite case, wherein the 'modulus' of (ε1) is matched to simply the dielectric constant (ε2) of the surrounding material (pgs.5-6).

Response to Arguments

Applicant's arguments filed 01/19/2007 have been fully considered but they are not persuasive.

With respect to claim 1, the applicant has essentially argued that the cited reference to Colombeli (APL) does not describe a waveguide layer that supports plasmon modes on both interfaces with the layer.

The examiner is of the belief that the majority of the light produced in the APL device is confined to the active region, noting gamma of 0.98, but not all of the light is confined to that layer. The material (GaAs based) and doping (n++) used to form the bottom plasmon layer are consistent with that which is needed to support plasmon modes as described in the applicant's specification, as well as by the APL paper. It is noted that the n++ doping is taught by the applicant and the APL, as well as very similar thickness values (APL=750nm, applicant's spec=800nm - pg.9). The APL additionally describes an amount of light is known to penetrate the heavily doped layer (pg.2622 col.2 para.1). The material type, doping, thickness, and known penetration of the light into the heavily doped layer lead to the conclusion that at least a portion of the light not confined to the active region would in fact be supported on the opposite interface of the

layer. For these reasons, the examiner is of the belief that the current rejection over Colombeli is proper.

The examiner does note that differences between the instant invention and that of the APL do exist, but are not clearly defined in the current claim language.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-2, 5, 7-10, and 12 are rejected under 35 U.S.C. 102(b) as being anticipated by Colombelli et al. ("Far infrared Surface Plasmon Quantum Cascade Lasers at 21.5um and 24um Wavelengths"; APL vol.28, no.18, pgs.2620-2622, April 30 2001, applicant submitted prior art).

With respect to claim 1, Colombelli discloses a semiconductor laser comprising: an active region which, in response to a pumping energy (electrical, fig.3) applied thereto, can produce a stimulated emission of radiation with a central wavelength in the far infrared region (pg.2620 col.2 para.1), and at least one confinement region (top metal plasmon layer, pg.2621 col.1 para.1, bottom doped layer, pg.2622 col.2 para.1) for confining the radiation in the active region and comprising at least one interface between adjacent layers that is capable of supporting plasmon modes generated by an interaction of the interface with the radiation (both layer interfaces capable), wherein the

at least one confinement region comprises a waveguide layer (n++, pg.2622 col.2 para.1, which replaces n InGaAs layer and location) which is delimited on opposite sides by a first interface (with InP substrate) and by a second interface (with active region), the guide layer being doped in a manner such that the first and second interfaces support the plasmon modes (due to doping, which would make the dielectric constant negative, compared with the positive constants on either side), respectively, and the guide layer being of a thickness such as to bring about the accumulation of the plasmon modes in proximity to the first and second interfaces, outside the layer, and substantially a suppression of the plasmon modes, inside the layer (thickness of 750nm, pg.2622 col.2 para.1, which would accumulate the modes near the interfaces, but only minimally inside the layer, see $\Gamma = 0.98$ for strong active region confinement).

With respect to claim 2, Colombelli discloses the plasmon modes of the first and second interfaces are mutually coupled (due to thickness, and partial penetration of the mode into the layer, pg.2622 col.2 para.1).

With respect to claim 5, Colombelli discloses the active region comprises a quantum cascade active region (pg.2620 col.2 para.1).

With respect to claim 7, Colombelli discloses the guide layer (recall - is to replace the n InGaAs layer) is interposed between the active region and the substrate region (pg.2621 col.1 para.1).

With respect to claim 8, Colombelli discloses the guide layer is in contact with the active region (pg.2621 col.1 para.1).

With respect to claim 9, Colombelli discloses a first electrical contact region disposed directly on the guide layer (InP substrate, pg.2620 col.2 para.2).

With respect to claim 10, Colombelli discloses a second contact region disposed directly on the active region (n InGaAs / n++ InGaAs, pg.2621 col.1 para.1).

With respect to claim 12, Colombelli discloses the thickness of the waveguide to be on the order of 100nm (750nm of same order as 100nm, pg.2622 col.2 para.1).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 11 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Colombelli et al.

With respect to claim 11, Colombelli teaches the laser outlined in the rejection to claim 1, and further teaches the use of the device for long wavelength (>50um) emitters (pg.2622 col.2 para.1). Colombelli does not produce a device that emits at between 30-

300um. It would have been obvious to one of ordinary skill in the art at the time of the invention to use an emitter having >50um output as Colombelli has taught that the waveguide losses would be reduced for this range (pg.2622 col.2 para.1).

With respect to claim 13 Colombelli teaches the laser outlined in the rejection to claim 1, and further teaches the guide layer to be formed of an n type semiconductor with an n++ "metal-like" doping value (pg.2622 col.2 para.1). Colombelli does not specify the doping value to be on the order of 10^18. It would have been obvious to one of ordinary skill in the art at the time of the invention to use a doping on the order of 10^18 as it has been found to be uninventive to determine the optimum or workable range (see MPEP 2144.05 II A – ("The normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages."); In re Hoeschele, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969)).

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Colombelli in view of Sirtori et al. ("Quantum cascade laser with plasmon enhanced waveguide operating at 8.4um wavelength"; APL, vol.66, no.24, pgs.3242-3244, 12 June 1995).

With respect to claim 6, Colombelli teaches the laser outlined in the rejection to claim 1, and further teaches the active region to have a non-uniform period (chirp, pg.2620 col.2 para.2). Colombelli does not teach the use of a GaAs/AlGaAs superlattice. Sirtori teaches a plasmon guiding device wherein the use of GaAs/AlGaAs

is described (pg.3242 col.1 para.1). It would have been obvious to one of ordinary skill in the art at the time of the invention to replace the active region material of Colombelli with the taught material of Sirtori in order to adjust the output frequency characteristics as desired.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period; then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tod T. Van Roy whose telephone number is (571)272-8447. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Minsun Harvey can be reached on (571)272-1835. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

TVR

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PRIMARY EXAMINER